CONCEPTUAL SUB-SLAB DEPRESSURIZATION (SSD) SYSTEM DESIGN
FOR
W-L MOLDING FACILITY
8212 SHAVER ROAD
PORTAGE, MICHIGAN

Pressure Field Extension Test Results

Suction Pit Tests

- The test was completed with one suction pit installed at TSP-1 (refer to Figure 4, *Site Plan with Pressure Field Extension Test Locations*).
- Initially, the suction pit was completed to a depth of 9 inches below ground surface (bgs) in medium-grained, dense sand immediately underlying the building.
- The test results from the shallow suction pit indicate that a radius of influence (ROI) of 7 to 11 feet could be generated with a blower producing greater than 50 inches water column (WC) and less than 12 standard cubic feet per minute (SCFM). Please refer to the *Graph of the Sub-Slab Depressurization Pressure Field Test*.
- The suction pit at TSP-1 was extended 3 feet bgs into the sand layer underlying the building.
- The test results from the deeper suction pit indicates a ROI of 48 feet could be generated with a blower producing 35 inches WC and 50 SCFM.

Conceptual Sub-Slab Depressurization System Design

Conceptual Design

- Note that the following conceptual SSD system is designed to induce an effective sub-slab vacuum only across the area of the facility having sub-slab soil gas exceedances, an area of approximately 28,500 square feet (SF) of the nearly 40,500 SF building. Additional extraction points and blowers would be necessary to cover the entire structure.

Vapor Extraction Points

- Based on the results from the deeper pressure field extension test, the SSD system should include at least five extraction points (suction pits) into the sand layer beneath the building (refer to Figure 5, Conceptualized Sub-Slab Depressurization System with Extraction Points). The suction pits should be extended into the sand layer beneath the fine-grained, medium dense sand immediately beneath the floor to a depth of at least 3 feet bgs.
- Trenching may be necessary dependent upon the final extraction point location.

Suction Piping

- The suction piping should be constructed with 3-inch-diameter schedule 40 polyvinyl chloride (PVC) materials (refer to Figure 5, *Conceptualized Sub-Slab Depressurization System with Extraction Points*). The suction piping should be increased to 4-inch-diameter when two or more pipes are joined.

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- The riser piping should be extended to the basement ceiling, then horizontally to the exterior wall of the building near the blower location, which should be mounted outside of the building. All horizontal runs should be sloped to ensure that condensation drains toward the extraction point. Long sweep pipe fittings will be used for all bends to minimize air flow noise and suction loss.
- Each suction point riser should be fitted with a shut-off valve for flow adjustment and a 0- to 25-inch WC differential pressure gauge to monitor system performance.

Test/Monitoring Points

- Test points should be installed at selected locations across the footprint of the building (including the original building and warehouse building) to serve as monitoring points to verify effective system coverage.

Blower

- It is recommended that one (1) 120 volt OBAR Systems, Inc. UD 76 Compact Radial Blower capable of pulling 115 scfm at a 19-inch water column be installed.
- The blower must be placed outside the structure or upon a non-occupied space above a conditioned space of the building.
- The blower should be installed in accordance with manufacturer specifications.
- A 4-inch-diameter PVC vent stack should be installed above the blower; the stack should be securely mounted and terminated a minimum distance of 10 feet above ground surface,
  2 feet above the top of the roof of the building and 10 feet away from any opening or vent into the building. The stack should be completed with a non-restricting rain guard with an exchangeable mesh to prevent nesting birds and insects.
- It may be necessary to install a silencer at the end of the stack to minimize exhaust noise.

Alarm / Remote Monitoring

- One or more visible vacuum gauges and audible alarm systems should be installed in occupied areas inside the facility to monitor system operation.
- It is recommended that a remote monitoring system be installed to provide notification to a designated individual when/if the system is not operating.

Startup and Monitoring

- Test points and existing vapor pins should be monitored following startup of the SSD system to verify adequate sub-slab depressurization beneath the building. Blower speed should be adjusted as necessary to achieve the recommended sub-slab vacuum of 0.02 inches WC across the footprint of the impacted (design) area. Note that additional extraction points and/or larger blower system may be necessary to achieve the required coverage across the design area.
- System inspections should be conducted daily during the first week of operation and at least monthly thereafter to verify system operation and document that the blower maintains an adequate pressure (vacuum) level, as established during startup.

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- An off-gas sample should be collected following startup, once the blower system has been adjusted for effective coverage. The sample should be field screened with a photo-ionization detector (PID) and submitted for laboratory analysis of volatile organic compounds (VOCs). The laboratory results should be evaluated for compliance with the Air Pollution Control rules. Provided the initial sample meets the effluent discharge limitations, it is recommended that the system effluent be monitored monthly for the first six months of operation utilizing a PID. An increase in PID readings may warrant the collection of additional laboratory samples. Provided there is no change in site conditions that would increase contaminant levels in the effluent, further effluent monitoring may not be required.
- W-L Molding should designate one or more individuals to verify system operation daily; the individual(s) should be trained regrading procedures to undertake if the system malfunctions.

Next Steps

- An *Installation Manual* including specifications and installation and construction drawings, along with a thorough list of equipment and supplies needed, can be prepared, if necessary.

References

1. Checklist for Reviewing the Design of an Active Mitigation System, Appendix C.5, Guidance Document for the Vapor Intrusion Pathway (MDEQ, May 2013)
2. Standard Practice for Installing Radon Mitigation Systems in Existing Low-Rise Residential Buildings (ASTM International E2121-09)
3. Radon Reduction Techniques for Existing Detached Houses - Technical Guidance (3rd Edition) for Active Soil Depressurization Systems (EPA 1993)

Attachments

Attachment 1. Figure 4: Site Plan with Pressure Field Extension Test Locations
Attachment 2. Figure 5: Conceptualized Sub-Slab Depressurization System with Extraction Points
Attachment 3. Graph of Sub-Slab Depressurization Field Test

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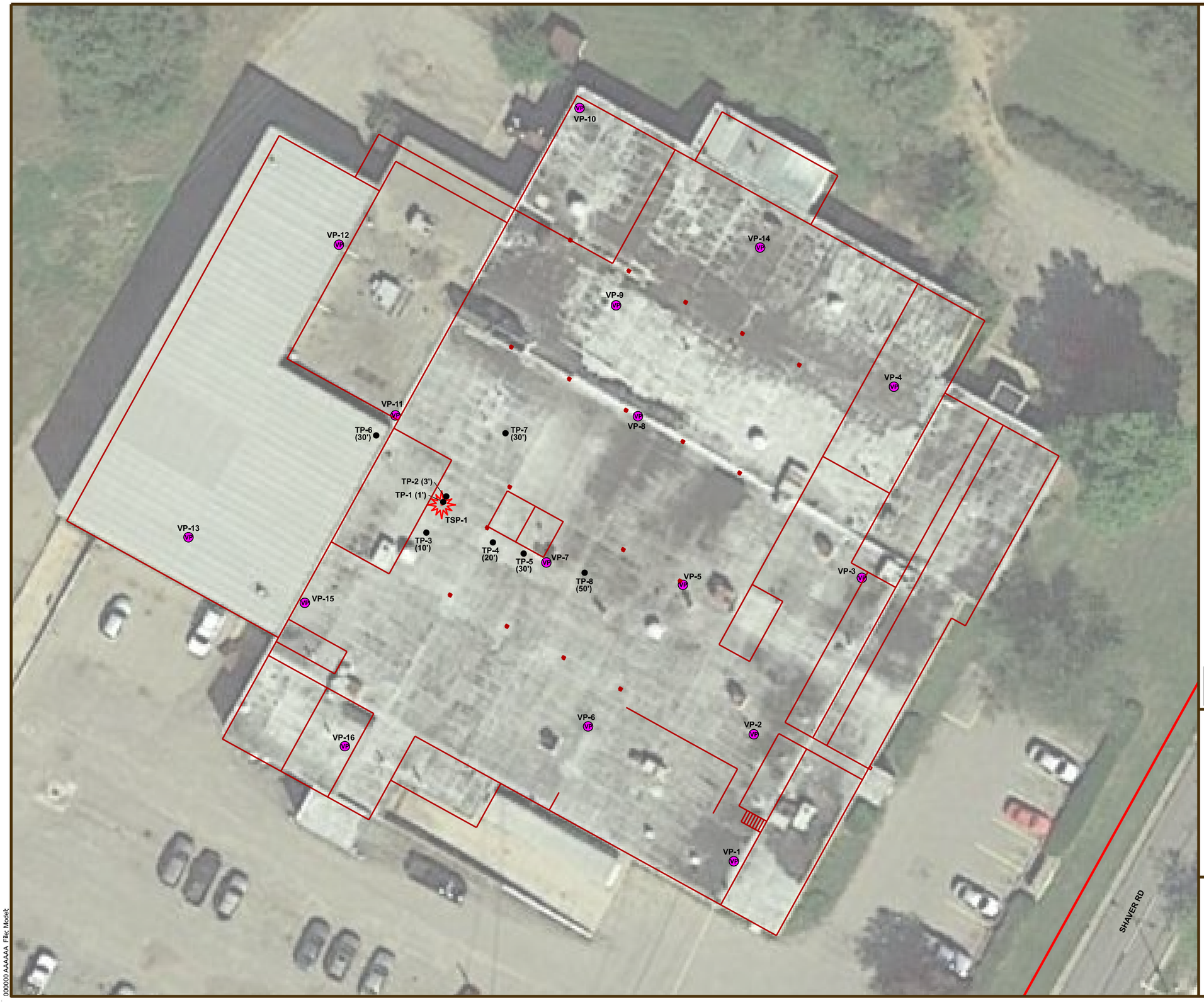

LEGEND

- VAPOR PIN LOCATION
- TEST POINTS
- TEST SUCTION PIT

N

SCALE 1" = 30'

0 5 10 20 30 60

NOTE:
THIS IS NOT A PROPERTY BOUNDARY SURVEY, PROPERTY BOUNDARIES SHOWN ON THIS MAP ARE BASED ON AVAILABLE FURNISHED INFORMATION AND ARE APPROXIMATE ONLY AND SHOULD NOT BE USED TO ESTABLISH PROPERTY BOUNDARY LOCATION IN THE FIELD.

W-L MOLDING

8212 SHAVER RD
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SITE PLAN w/ PRESSURE FIELD EXTENTION TEST LOCATIONS

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PROJECT NO.
160362

FIGURE No.
4

000000 AAAAAA File: Model:

VP-10
VP-12
VP-14
VP-9
VP-4
VP-11
VP-8
VP-13
VP-7
VP-5
VP-3
VP-15
VP-6
VP-2
VP-16
VP-1
SHAVER RD

LEGEND

- VAPOR PIN LOCATION
- PROPOSED SUCTION POINTS TO COVER AREAS OF SUB SLAB SOIL GAS EXCEEDANCES
- PROPOSED ADDITIONAL SUCTION POINTS TO COVER ENTIRE STRUCTURE
- APPROXIMATE AREA OF SUB SLAB DEPRESSURIZATION COVERAGE

N

SCALE 1" = 30'

0 5 10 20 30 60

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W-L MOLDING

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CONCEPTUAL SUB SLAB DEPRESSURIZATION SYSTEM WITH EXTRACTION POINTS

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PROJECT NO.
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FIGURE No.
5

000000 AAAAAA File: Model:

Sub-Slab Depressurization (Pressure) Field Test

Personnel Initials: MJB/Olga

Sheeet: 1 of 1

Site Name: WL Molding

Date: 9/17-18/18

Weather conditions: Temperature 76 F , Weather - Clear/Raining , Wind Minimum , Local Barometric Pressure 30.1-29.93 , Other:

Indoor/Outdoor pressure differential: -_____" H_20

Site Description [building construction, footers, floor condition (thickness, cracks), soil type, subsurface structures (pits, sumps, drains), utilities (location-sketch on map) etc.]:

Test Description: Test #1 from 9" x 4"ID pit, Test#2-8 from open 3.2' boring - loose sand at 3.2'.
Use OBAR UD and SOE blowers, adjusted amperage to regulate flow and vacuum, ARDCO Visi-Flow for CFM, Dwyer micro/manometers for vacuum measurents, Data assessment by PDF

Test Number	Suction Point Location	Blower	Amperage	Flow Rate (scfm)	Clock Time	Effluent (PID)	Suction Pit Riser (O_2)	Suction Pit Riser (LEL)	Suction Pit Riser Pre Fan ("H_20)	Suction Pit Riser Pre-Meter ("H_20)	TP-1 @1'	TP-2 @3'	TP-3 @10'	TP-4 @20'	VP-11 @ 29.9' NW	TP-5 @30'	TP-7 @30' N	TP-6 @30'W	VP-7 @37.4' E	TP-8 @ 50' E	VP-15 @ 51.9' S	
Background WC (" H2O)										0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	
Background PID (ppm)						Ambient -			0.2	1.7	0.7	0.7	0.6	0.8	0.2	0.4	--	0.8	0.1	--	0.6	
Test Results						Distance from Suction Pit >>				0.001	1	3	10	20	29.9	30	30	30	37.4	50	51.9	
1	TSP-1\Pit	UD	5.41	<12	1:20 AM	0.2			30.45	30.40	10.65	1.44	0.098	0.033	0.000	0.017		0.000	0.000		0.000	With Flow Meter/Pit
2	TSP-1\Boring	UD	6.61	40	3:00 PM	0.4			25.5	27.15	10.73	3.51	0.694	0.283	0.014	0.12		0.047	0.035		0.015	With Flow Meter/Boring to 3.2'
3	TSP-1\Boring	UD	6.56	NA	10:02 AM	0.4	20.6	0.0	26.46	26.53	11.68	3.61	0.718	0.240	0.02	0.13	0.156	0.052	0.041		0.018	Full Amp Without Flow Meter
4	TSP-1\Boring	UD	2.55	NA	10:35 AM	0.3	20.6	0.0	15.71	15.85	6.88	2.15	0.393	0.169	0.009	0.073	0.071	0.023	0.021	0.025	0.009	Without Flow Meter
5	TSP-1\Boring	UD	2.55	20	10:56 AM	0.3	--	--	15.44	15.85	6.73	2.08	0.393	0.173	0.012	0.079	0.085	0.030	0.024	0.047	0.011	With Flow Meter
6	TSP-1\Boring	SOE	1.86	20	11:20 AM	0.3	--	--	14.77	15.28	6.45	2.02	0.380	0.162	0.009	0.042	0.081	0.031	0.024	0.043	0.009	Full Amp With Flow Meter
7	TSP-1\Boring	SOE	1.43	<12	11:43 AM	0.3	--	--	12.1	12.46	5.2	1.65	0.304	0.130	0.010	0.051	0.061	0.029	0.012	0.011	0.009	Cut Amp w flow Meter
8	TSP-1\Boring	SOE	1.46	--	11:56 AM	0.0	--	--	12.18	12.46	5.24	1.67	0.295	0.114	0.009	0.048	0.055	0.021	0.011	0.012	0.001	Without Flow Meter

Test Number	Suction Point Location	Blower	Amperage	Flow Rate (scfm)	Clock Time	Effluent (PID)	Suction Pit Riser (O_2)	Suction Pit Riser (LEL)	Suction Pit Riser Pre Fan ("H_20)	Suction Pit Riser Pre-Meter ("H_20)	TP-1 @1'	TP-2 @3'	TP-3 @10'	TP-4 @20'	VP-11 @ 29.9' NW	TP-5 @30'	TP-7 @30' N	TP-6 @30'W	VP-7 @37.4' E	TP-8 @ 50' E	VP-15 @ 51.9' S	Notes
Background WC (" H2O)										0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	
Background PID (ppm)						Ambient -			0.2	1.7	0.7	0.7	0.6	0.8	0.2	0.4	--	0.8	0.1	--	0.6	
Test Results						Distance from Suction Pit >>				0.001	1	3	10	20	29.9	30	30	30	37.4	50	51.9	
1	TSP-1\Pit	UD	5.41	<12	1:20 AM	0.2			30.45	30.40	10.65	1.44	0.098	0.033		0.017					0.000	With Flow Meter/Pit
2	TSP-1\Boring	UD	6.61	40	3:00 PM	0.4			25.5	27.15	10.73	3.51	0.694	0.283		0.120					0.015	With Flow Meter/Boring to 3.2'
3	TSP-1\Boring	UD	6.56	NA	10:02 AM	0.4	20.6	0.0	26.46	26.53	11.68	3.61	0.718	0.240		0.130					0.018	Full Amp Without Flow Meter
4	TSP-1\Boring	UD	2.55	NA	10:35 AM	0.3	20.6	0.0	15.71	15.85	6.88	2.15	0.393	0.169		0.073					0.009	Without Flow Meter
5	TSP-1\Boring	UD	2.55	20	10:56 AM	0.3	--	--	15.44	15.85	6.73	2.08	0.393	0.173		0.079					0.011	With Flow Meter
6	TSP-1\Boring	SOE	1.86	20	11:20 AM	0.3	--	--	14.77	15.28	6.45	2.02	0.380	0.162							0.009	Full Amp With Flow Meter
7	TSP-1\Boring	SOE	1.43	<12	11:43 AM	0.3	--	--	12.1	12.46	5.2	1.65	0.304	0.130		0.051				0.011	0.009	Cut Amp w flow Meter
8	TSP-1\Boring	SOE	1.46	--	11:56 AM	0.0	--	--	12.18	12.46	5.24	1.67	0.295	0.114		0.048				0.012	0.000	Without Flow Meter